

WHAT IS CLAIMED IS:

5 1. A method for creating a composite image of at least one object, the method comprising:

recording a plurality of images of the object using an image recording device moving along a path;

obtaining position information of the image recording device as the image recording device moves along the path;

10 associating the position information with the plurality of images; and

processing image data acquired from the plurality of images to create a composite image representing the object.

15 2. The method of claim 1, wherein the object is located on a first side of the path and the composite image simulates a view of the object from a particular location on a second side of the path opposite from the first side.

20 3. The method of claim 2, wherein the processing of the image data comprises:

identifying a plurality of optical rays originating from the particular location;

25 selecting for each optical ray an image including a corresponding optical ray originating from a position on the path;

30 extracting image data for the corresponding optical ray from the selected images; and

combining the extracted image data to form the composite image.

35 4. A method for creating a composite image of at least one object, the method comprising:

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recording a plurality of images of the objects using an image recording device moving along a path;

5 obtaining position information of the image recording device as the image recording device moves along the path;

associating the position information with the plurality of images; and

10 processing image data acquired from the plurality of images to create a composite image depicting a view of the object from a particular location.

15 5. The method of claim 4, wherein the object is located on a first side of the path and the composite image simulates a view of the object from the particular location on a second side of the path opposite from the first side.

20 6. The method of claim 4, wherein the obtaining of position information comprises obtaining Global Positioning System (GPS) data.

25 7. The method of claim 4, wherein the obtaining of position information comprises:

obtaining acceleration information of the image recording device as the image recording device moves along the path; and

deriving the position information from the acceleration information.

30 8. The method of claim 4, wherein the obtaining of position information comprises deriving the position information of the image recording device at a particular time by computing a motion of objects in a plurality of images closest to the
35 particular time.

9. The method of claim 4, wherein the associating of the position information comprises correlating times associated with the position information to times of acquisition of the plurality of images.

10. The method of claim 4, wherein the processing of the image data comprises:

10 identifying a plurality of optical rays originating from the particular location;

selecting for each optical ray an image including a corresponding optical ray originating from a position on the path;

15 extracting image data for the corresponding optical ray from the selected images; and

combining the extracted image data to form the composite image.

20 11. The method of claim 10, wherein the selecting of an image for each optical ray comprises:

determining the particular position on the path where the image recording device would have been located for recording an image including the corresponding optical ray;

25 calculating a time associated with the determined position; and

identifying an image recorded at the calculated time.

30 12. The method of claim 10, wherein the selecting of an image for each optical ray comprises:

determining the particular position on the path where the image recording device would have been located for recording an image including the corresponding optical ray;

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calculating a time associated with the determined position;

5 selecting an image recorded closest to the calculated time.

13. The method of claim 10, wherein the selecting of an image for each optical ray comprises:

10 determining the particular position on the path where the image recording device would have been located for recording an image including the corresponding optical ray;

calculating a time associated with the determined position;

15 selecting a plurality of images recorded closest to the calculated time;

computing a motion of objects in the selected images; and
creating a new image frame for the calculated time based
20 on the computed motion of objects.

14. The method of claim 4, wherein the image data comprises a set of pixel values.

25 15. The method of claim 4, wherein the recording of the images comprises recording the images from multiple viewing directions using multiple image recording devices.

30 16. A method for creating a composite image database of a particular geographic area, the method comprising:

recording a plurality of images of a series of objects using an image recording device moving along a path;

obtaining position information of the image recording
35 device as the image recording device moves along the path;

associating the position information with the plurality of images;

5 processing image data acquired from the plurality of images to create a composite image depicting a view of the series of objects from a particular location;

partitioning the path into a plurality of discrete segments;

10 associating the composite image to one of the discrete segments ; and

storing the composite image and association information in the composite image database.

15 17. The method of claim 16, wherein the recording of the images comprises recording the images from multiple viewing directions using multiple image recording devices.

20 18. The method of claim 16, wherein the obtaining of position information comprises obtaining Global Positioning System (GPS) data.

25 19. The method of claim 16, wherein the obtaining of position information comprises:

obtaining acceleration information of the image recording device as the image recording device moves along the path; and

30 deriving the position information from the acceleration information.

20. The method of claim 16, wherein the obtaining of position information comprises deriving the position information of the image recording device at a particular time by computing
35 a motion of objects in a plurality of images closest to the particular time.

21. The method of claim 16, wherein the associating of
5 the position information comprises correlating times associated
with the position information to times of acquisition of the
plurality of images.

22. The method of claim 16, wherein the object is located
10 on a first side of the path and the composite image simulates
a view of the object from the particular location on a second
side of the path opposite from the first side.

23. The method of claim 16, wherein the processing of the
15 image data comprises:

identifying a plurality of optical rays originating from
the particular location;

selecting for each optical ray an image including a
20 corresponding optical ray originating from a position on the
path;

extracting image data for the corresponding optical ray
from the selected images; and

combining the extracted image data to form the composite
25 image.

24. The method of claim 23, wherein the selecting of an
image for each optical ray comprises:

determining the particular position on the path where the
30 image recording device would have been located for recording an
image including the corresponding optical ray;

calculating a time associated with the determined
position; and

35 identifying an image recorded at the calculated time.

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25. The method of claim 23, wherein the selecting of an image for each optical ray comprises:

5 determining the particular position on the path where the image recording device would have been located for recording an image including the corresponding optical ray;

calculating a time associated with the determined position; and

10 selecting an image recorded closest to the calculated time.

26. The method of claim 23, wherein the selecting of an image for each optical ray comprises:

15 determining the particular position on the path where the image recording device would have been located for recording an image including the corresponding optical ray;

calculating a time associated with the determined position;

20 selecting a plurality of images recorded closest to the calculated time;

calculating a motion of objects in the selected images; and

25 creating a new image frame for the calculated time based on the computed motion of objects.

27. The method of claim 16, wherein the image data comprises a set of pixel values.

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28. The method of claim 16, wherein the partitioning of the path into a plurality of discrete segments comprises:

detecting an intersection on the path; and

35 identifying the position of the intersection.

29. The method of claim 28 wherein the detecting of the intersection comprises detecting a point of maximum curvature
5 on the path.

30. The method of claim 16 wherein each discrete segment is associated with a plurality of composite images, each composite image depicting a portion of the associated segment.
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31. The method of claim 16, wherein each discrete segment is a portion of a street and the method further comprises associating each discrete segment with a street name and number range.
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32. In a system including an image database and a user terminal having a screen and an input device, a method for visually navigating a geographic area from a user terminal, the method comprising:
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storing a plurality of images in the image database representing substantially all static objects within the geographic area;

identifying a current location in the geographic area;
25 retrieving an image corresponding to the current location from the image database;

monitoring a change of the current location in the geographic area; and

30 retrieving an image corresponding to the changed location.

33. The method of claim 32, wherein image database resides at a remote site and a host computer at the remote site receives a request via a communications network for an image
35 corresponding to the current or changed location, retrieves the requested image from the image database, and transmits the

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retrieved image to the user terminal via the communications network.

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34. The method of claim 32, wherein the image database resides at the user terminal and the method further comprises:

displaying the image corresponding to the current location on the screen of the user terminal; and

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updating the image on the screen with the image corresponding to the changed location.

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35. The method of claim 32 further comprising retrieving a map of a portion of the geographic area for displaying the map on the screen of the user terminal.

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36. The method of claim 35, wherein the current or changed location is identified by a user selection of the location on the map using the input device.

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37. The method of claim 32, wherein the current or changed location is identified by a specific address entered by the user using the input device.

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38. The method of claim 32, wherein the retrieving of the image corresponding to the current or changed location comprises:

identifying a street segment including the current or changed location;

identifying a position on the street segment corresponding to the current or changed location; and

identifying an image associated with said position.

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39. The method of claim 38, wherein the image simulates
a view of objects on one side of the street segment and the
5 method further comprises retrieving a second image depicting a
view of objects on an opposite side of the street segment in
response to a user request.

40. The method of claim 32, wherein the image is a
10 composite image created by processing a plurality of image
frames acquired from an image recording device moving through
the geographic area.

41. The method of claim 32 further comprising:
15 displaying an indicia that information is available about
an object in the image; and
retrieving information about the object in response to a
user request to display the information on the screen of the
20 user terminal.

42. The method of claim 32 further comprising:
displaying a navigation button on the screen of the user
terminal; and
25 retrieving the image associated with the changed location
from the image database upon actuation of the navigation button
using the user input device.

43. The method of claim 32 further comprising:
30 displaying a map of a portion of the geographic area;
identifying the current location with an identifier on the
map; and
advancing the identifier on the map from the current
35 location to the changed location.

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44. The method of claim 32 further comprising identifying a current viewing direction associated with the retrieved image.

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45. A system for creating a composite image of a series of objects, the system comprising:

an image recording device moving along a path and recording a plurality of images of the objects;

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a means for receiving position information of the image recording device as the image recording device moves along the path; and

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a processor receiving the plurality of images and position information, the processor being operable to execute program instructions including:

associating the position information with the plurality of images; and

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processing image data acquired from the plurality of images to create a composite image depicting a view of the object from a particular location.

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46. The system of claim 45 wherein multiple image recording devices record the images from multiple viewing directions.

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47. The system of claim 45, wherein the object is located on a first side of the path and the composite image simulates a view of the object from the particular location on a second side of the path opposite from the first side.

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48. The system of claim 45, wherein the means for receiving position information comprises means for obtaining acceleration information of the image recording device as the image recording device moves along the path.

49. The system of claim 45, wherein the means for
5 receiving position information comprises means for receiving GPS
data.

50. The system of claim 45, wherein the associating of
the position information comprises correlating times associated
10 with the position information to times of acquisition of the
plurality of images.

51. The system of claim 45, wherein the processing of the
15 image data comprises:

identifying a plurality of optical rays originating from
the particular location;

selecting for each optical ray an image including a
corresponding optical ray originating from a position on the
20 path;

extracting image data for the corresponding optical ray
from the selected images; and

combining the extracted image data to form the composite
image.
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52. The system of claim 51, wherein the selecting of an
image for each optical ray comprises:

determining the particular position on the path where the
image recording device would have been located for recording an
30 image including the corresponding optical ray;

calculating a time associated with the determined
position; and

identifying an image recorded at the calculated time.
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53. The system of claim 51, wherein the selecting of an image for each optical ray comprises:

5 determining the particular position on the path where the image recording device would have been located for recording an image including the corresponding optical ray;

calculating a time associated with the determined position;

10 selecting an image recorded closest to the calculated time.

54. The system of claim 51, wherein the selecting of an image for each optical ray comprises:

15 determining the particular position on the path where the image recording device would have been located for recording an image including the corresponding optical ray;

calculating a time associated with the determined position;

20 selecting a plurality of images recorded closest to the calculated time;

calculating a motion of objects in the selected images; and

25 creating a new image frame for the calculated time based on the computed motion of objects.

55. The system of claim 45, wherein the image data comprises a set of pixel values.

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56. A system for creating a composite image database of a particular geographic area, the system comprising:

an image recording device moving along a path and
35 recording a plurality of images of a series of objects;

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means for obtaining position information of the image recording device as the image recording device moves along the path;

means for associating the position information with the plurality of images;

means for processing image data acquired from the plurality of images to create a composite image depicting a view of the series of objects from a particular location;

means for partitioning the path into a plurality of discrete segments;

means for associating the composite image to one of the discrete segments; and

means for storing the composite image and association information in the composite image database.

57. The system of claim 56 wherein multiple image recording devices record the images from multiple viewing directions.

58. The system of claim 56, wherein the means for associating comprises means for correlating times associated with the position information to times of acquisition of the plurality of images.

59. The system of claim 56, wherein the object is located on a first side of the path and the composite image simulates a view of the object from the particular location on a second side of the path opposite from the first side.

60. The system of claim 56, wherein the means for processing the image data comprises:

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means for identifying a plurality of optical rays
originating from the particular location;

5 means for selecting for each optical ray an image
including a corresponding optical ray originating from a
position on the path;

means for extracting image data for the corresponding
optical ray from the selected images; and

10 means for combining the extracted image data to form the
composite image.

61. The system of claim 60, wherein the means for
15 selecting an image for each optical ray comprises:

means for determining the particular position on the path
where the image recording device would have been located for
recording an image including the corresponding optical ray;

20 means for calculating a time associated with the
determined position; and

means for identifying an image recorded at the calculated
time.

62. The system of claim 60, wherein the means for
25 selecting an image for each optical ray comprises:

means for determining the particular position on the path
where the image recording device would have been located for
recording an image including the corresponding optical ray;

30 means for calculating a time associated with the
determined position; and

means for selecting an image recorded closest to the
calculated time.

63. The system of claim 60, wherein the means for
35 selecting of an image for each optical ray comprises:

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means for determining the particular position on the path
where the image recording device would have been located for
5 recording an image including the corresponding optical ray;

means for calculating a time associated with the
determined position;

means for selecting a plurality of images recorded closest
to the calculated time;

10 means for calculating a motion of objects in the selected
images; and

means for creating a new image frame for the calculated
time based on the computed motion of objects.

15 64. The system of claim 56, wherein the image data
comprises a set of pixel values.

65. The system of claim 56, wherein the means for
20 partitioning the path comprises:

means for detecting an intersection on the path; and

means for identifying the position of the intersection.

25 66. The system of claim 56 wherein each discrete segment
is associated with a plurality of composite images, each
composite image depicting a portion of the associated segment.

67. The system of claim 56, wherein each discrete segment
30 is a portion of a street and the system further comprises means
for associating each discrete segment with a street name and
number range.

68. A system for visually navigating a geographic area
35 from a user terminal, the system comprising:

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means for storing a plurality of images in the image
database representing substantially all static objects within
5 the geographic area;

means for identifying a current location in the geographic
area;

means for retrieving an image corresponding to the current
location from the image database;

10 means for monitoring a change of the current location in
the geographic area; and

means for retrieving an image corresponding to the changed
location.

15 69. The system of claim 68, wherein the image database
resides at a remote site and the system further comprises a host
computer including means for receiving a request for an image
corresponding to the current or changed location, means for
20 retrieving the requested image from the image database, and
means for transmitting the retrieved image to the user terminal.

70. The system of claim 68, wherein the image database
resides at the user terminal and the system further comprises:
25 a display screen for displaying the image of the current
location; and

means for updating the image on the screen with the image
corresponding to the changed location.

30 71. The system of claim 68 further comprising means for
retrieving a map of a portion of the geographic area for
displaying the map on the screen of the user terminal.

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72. The system of claim 71, wherein the current or
changed location is identified by a user selection of the
5 location on the map using in the input device.

73. The system of claim 68, wherein the current or
changed location is identified by a specific address entered by
the user using an input device.

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74. The system of claim 68, wherein the means for
retrieving the image corresponding to the current or changed
location comprises:

15 means for identifying a street segment including the
current or changed location;

means for identifying a position on the street segment
corresponding to the current or changed location; and

20 means for identifying an image associated with said
position.

75. The system of claim 74, wherein the image simulates
a view of objects on one side of the street segment and the
system further comprises means for retrieving a second image
25 depicting a view of objects on an opposite side of the street
segment in response to a user request.

76. The system of claim 68 further comprising means for
processing a plurality of image frames acquired from an image
30 recording device moving through the geographic area.

77. The system of claim 68 further comprising:
means for indicating that information is available about
35 an object in the image;

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means for retrieving information about the object in
response to a user request to display the information on the
5 screen of the user terminal.

78. The system of claim 68 further comprising:
means for navigating the image database; and
means for retrieving the image associated with the next
10 location from the image database as the user navigates the image
database.

79. The system of claim 68 further comprising:
15 means for displaying a map of a portion of the geographic
area;
means for identifying the current location on the map; and
means for identifying the next location on the map as the
user navigates the image database.

20 80. The system of claim 68 further comprising means for
identifying a current viewing direction associated with the
retrieved image.

25 81. A computer-readable medium comprising:
a program code embodied in the computer readable medium
for creating a composite image of a series of objects from a
plurality of images acquired by an image recording device moving
30 along a path, the computer-readable program segment comprising
instructions for performing the steps of:

identifying a plurality of optical rays originating from
a particular location;

35 selecting for each optical ray an image including a
corresponding optical ray originating from a position on the
path;

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extracting image data for the corresponding optical ray
from the selected images; and

5 combining the extracted image data to form the composite
image.

82. The computer-readable medium of claim 79, wherein the
step of selecting an image for each optical ray comprises:

10 determining the particular position on the path where the
image recording device would have been located for recording an
image including the corresponding optical ray;

calculating a time associated with the determined
position; and

15 identifying an image recorded at the calculated time.

83. The computer-readable medium of claim 79, wherein the
step of selecting an image for each optical ray comprises:

20 determining the particular position on the path where the
image recording device would have been located for recording an
image including the corresponding optical ray;

calculating a time associated with the determined
position;

25 selecting an image recorded closest to the calculated
time.

84. The computer-readable medium of claim 79, wherein the
step of selecting an image for each optical ray comprises:

30 determining the particular position on the path where the
image recording device would have been located for recording an
image including the corresponding optical ray;

calculating a time associated with the determined
35 position;

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selecting a plurality of images recorded closest to the
calculated time;

5 calculating a motion of objects in the selected images;
and

creating a new image frame for the calculated time based
on the computed motion of objects.

10 85. The computer-readable medium of claim 79, wherein the
image data comprises a set of pixel values.

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